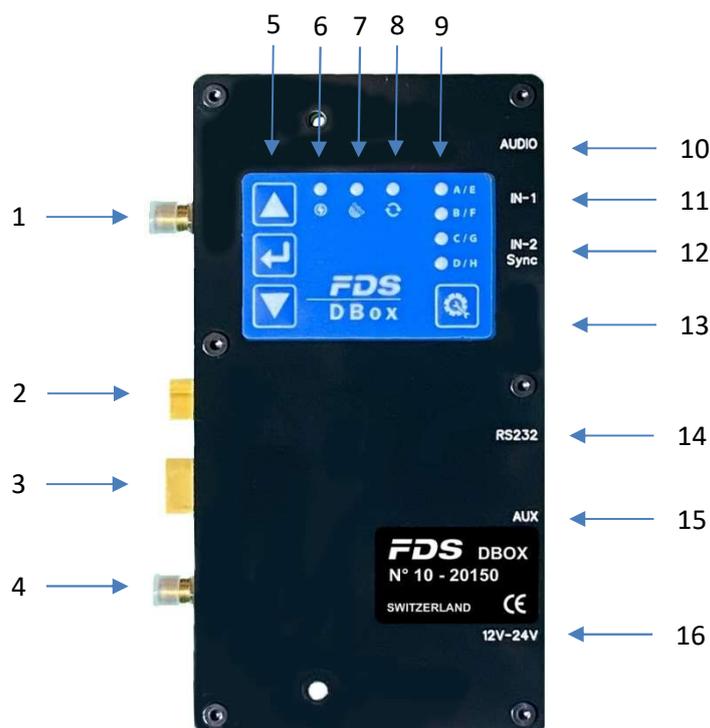


1. Presentation



1.1. Switches and connectors

- 1) Radio antenna 868Mhz-915Mhz (SMA connector)
- 2) MLED connections (RS232)
- 3) MLED connections (Power)
- 4) Active GPS antenna (SMA connector)
- 5) Selection switches
- 6) Power Led
- 7) GPS Led
- 8) Synchro Led
- 9) Radio LEDs and switch
- 10) Audio out (Jack 3.5mm)
- 11) Input 1 (Jack 3.5mm)
- 12) Input 2 / Sync Output (Jack 3.5mm)
- 13) USB C
- 14) RS232 Main (Jack 3.5mm)
- 15) Auxiliary RS232 / RS485
- 16) Power connector (12V-24V)

2. Connections

2.1. Power

The DBox can be powered either via the main power connector (12V to 24V) or via USB if no MLED is connected.

In case power connector is used, It will forward power to the connected MLED modules. Current drawn will depend of the input voltage as well as the number of MLED panels connected.

2.2. Audio output

In some display modes, audio tones are generated on the 3.5mm stereo jack connector.

2.3. Timing Inputs / Outputs

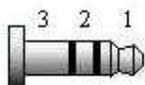
The DBox comprises of 2 hardware inputs, 6 wireless (Radio) inputs and 1 synchro output.

- Jack inputs (inputs 1 & 2)
Working contact without potential (short-circuit)
- Wireless inputs for WIRC / WINP (inputs A - F)
- Synchro Output on Jack 2
Opto-coupled output to GND.

2.3.1. Input_1

This 3.5mm jack connector

1) Time capture input 1

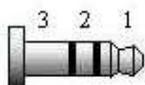


- 1: External input 1
- 2: Input 2 for future use
- 3: GND

2.3.2. Input_2 / Output

This 3.5mm jack connector combines 2 functionalities.

- 1) Time capture input 2
- 2) General purpose output (optocoupled)



- 1: External input 2
- 2: Output
- 3: GND

If output is not used, an FDS jack to Banana cable can be used to connect an input switch. If output is used, a special adaptor cable is required.

Each wired or radio impulses are stored in the DBox memory, with associated date and time. The user has the ability to configure a locking time using the “Device Manager” App. This facility allows the blocking of undesired impulses corresponding to the channel configured.

E.g. – To ignore multiple impulses from dirt or snow dust.

2.4. USB-C

The USB connector has various functions including:

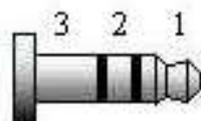
- External power supply when no MLED connected.
- COM port emulation for RS232 communication and data transfer
 - Time of day (protocol FDS, TAG Heuer, Alge, Seiko)
 - Configure all parameters (with the app “Device Manager”)
- 4GB USB Flash Drive
 - All impulse data are stored in a .csv file on the DBox internal SD drive
A new file is created every time the DBox is powered.
 - A log file is updated in an event of a firmware crash
 - User needs to maintain sufficient memory availability to ensure storage of data
 - The space required for a competition of 1000 times is approximately 40 Kbytes
 - The drive is not accessible during normal operation. To have access you need to power up the DBox while holding the ‘Enter’ key down.

2.5. RS232

Jack-Stereo connection 3.5mm.

In conjunction with the Device Manager, the protocol output can be configured by the user.

- FDS Binary / FDS Timer & TAG Heuer / Alge / Seiko Time of day protocol
- Serial printer
- LEDs Display Output (MLED)

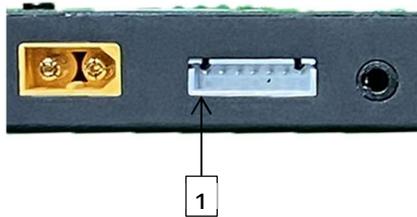


- 1: DBox TXD
- 2: DBox RXD
- 3: GND

2.6. Auxiliary port (2nd RS232 & RS485)

7 pin 2.54 header

- RS232 port for auxiliary units
- RS485 port sharing the same UART as the RS232 (RS485 is enabled when no valid signal detected on RS232)



- 1: Supply +3.3V
- 2: Aux unit detection
- 3: RS485 A
- 4: RS485 B
- 5: Aux RS232 RXD
- 6: Aux RS232 TXD
- 7: GND

3. Printer

FDS offer a dedicated thermal printer which can be connected either to the DBox via its RS232 port or via Bluetooth using one of our iOS timing applications. In case of a DBox direct connection, all the generated time stamps will be printed, as well as the synchro time and the GPS status if used. Each DBox modes have also specific data that are printed out.

4. Synchronization

There are 4 different methods to synchronize a DBox.

The synchro LED will flash yellow until a synchro is completed.

All synchro modes can be start using one of our App.

a) Internal Sync

- This is the default synchro method unless the startup GPS synchro option is selected. Once the DBox is powered ON, it is synchronized with the internal RTC. RTC value is updated during a GPS or App Synchro.

b) GPS Sync

- The synchro will start once the DBox receives sufficient GPS data.
- Once synchronized, the internal clock drift is constantly compensated by GPS signals (as long as GPS coverage is maintained).
- If the GPS synchro is not selected by default, it is still possible to manually start the GPS synchro by holding down the key “UP” while powering ON the DBox.

c) Manual

- A user defined time of day is sent via Bluetooth or via a com port. The synchro is started using one of the 2 wired inputs.

d) Sync via app

- Synchronized with the time of the PC or mobile device.

5. Bluetooth

A Bluetooth connection can be established with compatible FDS timing or setup Apps.

Apps developers can contact us for more information as well as protocol documentation.

6. Radio configuration

The DBox is configured and linked to other radio devices using two Parameters:

- **Group** (radio frequency)
- **Input/ID** (DBox Input / WIRC-WINP serial number)

NOTE: All radio devices must be configured with an identical Group setting to communicate together.

6.1. Groups (Radio Frequencies) – For Europe / India / Russia

6 Groups are available.

Group A, B, C, D:

Wireless Transmission Distance: up to 2000m (clear line of sight)

Each group uses $\frac{1}{4}$ of the full frequency band.

Min locking time of 200ms

Group E, F:

Wireless Transmission Distance: up to 4000m (clear line of sight)

Each group uses the full frequency band.

Min locking time is longer: 500ms.

OFF:

The radio transmission function is disabled. This mode is selected when you prefer to connect DBox to photocells using a hard-wired solution rather than wireless.

6.2. Groups (Radio Frequencies) – For North America / Japan

8 Groups are available.

Group A, B, C, D:

Tested wireless Transmission Distance (clear line of sight)

US : up to 4000m

Japan : up to 1000m

Min locking time of 200ms

Group E, F, G, H:

Tested wireless Transmission Distance (clear line of sight)

US : up to 6000m

Japan : up to 1500m

Min locking time of 500ms

OFF:

The radio transmission function is disabled. This mode is selected when you prefer to connect DBox to photocells using a hard-wired solution rather than wireless.

6.3. Group selection

To select your desired Group, press the Setup button 

The current Group selected is indicated by the LED array **A, B, C & D**.

Release and press the number of times you want to change the setting.

Group	LED A	LED B	LED C	LED D
A	GREEN			
B	GREEN	GREEN		
C	GREEN	GREEN	GREEN	
D	GREEN	GREEN	GREEN	GREEN
E	YELLOW			
F	YELLOW	YELLOW		
G (*)	YELLOW	YELLOW	YELLOW	
H (*)	YELLOW	YELLOW	YELLOW	YELLOW
OFF	RED	RED	RED	RED

(*) only available for North America and Japan

To prevent unwanted radio group changes, the radio Setup button can be locked / unlocked by a simultaneous long press on both radio button and Power button.

LEDs A and Led D will flash red (locked) or green (unlocked).

6.4. Radio Input (WINP/WIRC/WISG Pairing)

Each device has a unique ID (serial number) that can be paired with a DBox input (A-F). Pairing can be performed on a DBox using the “Device Manager” application (no need to power ON WIRC/WINP). Pairing can also be performed manually without any application. In this case, both DBox and WINP/WIRC have to be powered and the following procedure executed.

- 1) Make sure the DBox and the WINP/WIRC are both powered On.
- 2) On the DBox, enter the pairing mode by pressing the Setup button  for 3 sec until a long beep sounds and LED A flash yellow.
- 3) Now select the desired input (A, B, C or D) by performing a short press on the same button.
- 4) Finally enter the pairing mode on the WINP/WIRC by pressing the Setup button  for 3 second.

When pairing is completed, LEDs A to D of the DBox flash yellow and both DBox and WINP/WIRC resume normal operation.

To exit the pairing mode on either DBox or WINP/WIRC, just press the Setup button for 3 second until a long beep sound.

NOTE: In case a mobile or PC application is used to configure the radio inputs, do not use the same WIRC/WINP serial number for more than one input.

7. Radio communication

Every time an impulse is received from a WINP/WIRC, the corresponding input LED flash on the DBox and an acknowledgement is sent back to the WIRC/WINP.

WIRC/WINP radio protocol will resend any message several times if no ACK is received from the DBox.

 Radio transmissions cannot be 100% guaranteed. An unfavorable environment, lack of line of sight, interference or an improper installation might lead to the loss of data. FDS cannot be held responsible for any of the above.

7.1. Time delay and precision

In case of a good radio communication with no interference, the time delay from the IR beam detection to the generation of a time event by the DBox will vary from 10ms to 150ms depending on the selected Group. In case of interferences this delay might reach a few seconds. However, whatever the delay value, the DBox takes this delay into account and generates a corrected time event with a precision of 1/10'000 sec.

8. WIRC / WINP / WISG

WIRC, WINP or WISG can be used to send impulses in modes "Start-Finish", "Speed trap", "Counter", "Count-Down".

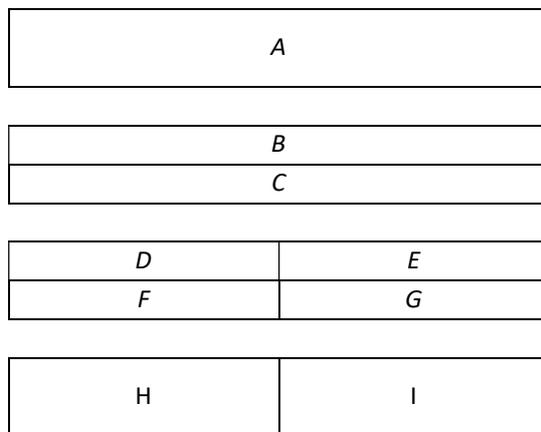
Pulses on inputs A & B can be used either as time data or to trigger some functionalities of the selected operation mode (for example a start of countdown or sequence reset).

Important:

Do not use a same WIRC/WINP/WISG on a DBox and a TBox simultaneously.

9. MLED assembly

The most common configuration comprises of 3 or 4 x MLED panels adjoined to form a display fully configurable to either a single full height line of characters or multiple lines as below. Another configuration proposed is 2 rows of 6 modules which form a 192x32cm display area. The total display area is divided into 9 zones (A – I) as the schematic below. Be aware that some zones share the same display area and should not be used together. A line number as well as a color can be assigned to each zone via the IOS or PC setup application. It is recommended to assign the value “0” to any unused zone. The DBox must always be connected to the lower right MLED module.



Display with 3 x MLED panels (MLED-3C):

Zone A: 8-9 characters, height 14-16cm depending on the font type selected.
 Zone B - C: 16 characters per zone, height 7cm
 Zone D - G: 8 characters per zone, height 7cm
 Zone H - I: 4 characters per zone, height 14-16cm

Display with 2x6 MLED panels (MLED-26C):

Zone A: 8-9 characters, height 28-32cm depending on the font type selected.
 Zone B - C: 16 characters, height 14-16cm per zone
 Zone D - G: 8 characters, height 14-16cm per zone
 Zone H - I: 4 characters, height 28-32cm per zone

10. Operating Mode

Seven operating modes are available:

- 1) User Control via RS232 (default mode for timing with external applications)
- 2) Time / Date
- 3) Start-Finish
- 4) Speed trap
- 5) Counter
- 6) Start Clock

Modes can be selected and configured either via our mobile or PC setup application. Modes 2-6 are optimized for MLED-3C and MLED-26C configuration. Some of them also work with MLED-1C.

10.1. User Control Mode

This is the general display mode for which you can send data from your own preferred software. Information can be displayed using either the USB/RS232/RS485 port (using FDS / TAG Heuer protocol) or via Bluetooth using our mobile applications.

This is the only mode giving full access to the display zones described in chapter 9.

This is the mode to use for timing when DBox is replacing a TBox. Other modes can be used but have some restrictions on inputs 1, 2, A, B.

The parameter 'Radio protocol' has to be set to 'Timing' if connection with WIRC is required, otherwise the radio is used to send data to display.

10.2. Time / Date

Alternating time and date, each of which can be pre-defined colors selected by the user for optimum and eye-catching visual impact.

Time and Date value depend on the selected DBox synchro.

Time of day is put on hold when a pulse on input 2/B is received.

10.3. Start-Finish Mode

Start-Finish mode is a simple yet accurate mode of displaying time taken between 2 positions or inputs. This mode works with the external Jack inputs 1 & 2 (wired solution), and / or radio input A & B (WIRC/WINP).

Two input sequence modes are available:

a) Sequenced mode (Normal)

- On receiving an impulse on jack input 1 or wirelessly via WIRC A, the running time starts.
- On receiving an impulse on jack input 2 or wirelessly via WIRC B, the time taken is displayed.

b) No sequenced mode (Any Inputs)

- Starts and Finish actions are triggered by any Inputs 1-2 or WIRC A-B.

Besides Start/Finish impulse acquisition, jack inputs 1 & 2 have two other alternate functions when using Radio inputs:

Alternate Function	Short pulse	Long pulse
1	Block/Unblock WIRC A or B Impulses	Reset sequence
2	Block/Unblock WIRC A and B Impulses	Reset sequence

- The Result is displayed for a predefined duration (or permanently) as per the user selected parameter.
- Jack and Radio Inputs 1/A & 2/B lock time can be modified.
- The running time / time taken can be any color pre-defined by the user.

10.4. Speed trap Mode

Speed mode is a simple yet accurate mode of displaying speed between 2 positions or inputs. This mode works with the external Jack inputs 1 & 2 (wired solution), and / or radio input A & B (WIRC/WINP).

Distance measured, speed color and unit displayed (Km/h, Mph, m/s, knots) and can be configured via our setup Apps.

Two input sequence modes are available:

a) Sequenced mode (Normal)

- On receiving an impulse on jack input 1 or wirelessly via WIRC A, start time is recorded
- On receiving an impulse on jack input 2 or wirelessly via WIRC B, finish time is recorded. Speed is then calculated (using the time difference and distance) and displayed.

b) No sequenced mode (Any Inputs)

- Starts and Finish actions are triggered by any Inputs 1-2 or WIRC A-B.
- Speed is then calculated and displayed.

Besides impulse generation, jack inputs 1 & 2 have two other alternate functions when using Radio inputs:

Alternate Function	Short pulse	Long pulse
1	Block/Unblock WIRC A or B Impulses	Reset sequence
2	Block/Unblock WIRC A and B Impulses	Reset sequence

- The Speed is displayed for a predefined duration (or permanently) as per the user selected parameter.
- Jack and Radio Inputs 1/A & 2/B lock time can be modified.
- The speed value and units can be any color pre-defined by the user.

10.5. Counter Mode

- This mode works with the external Jack inputs 1 & 2 (wired solution), and / or radio input A & B (WIRC/WINP).
- User can chose between 1 or 2 counters and several predefined counting sequences.
- For single counter, Jack input 1 or WIRC A is used for counting up and Jack input 2 or WIRC B for counting down.
- For dual counter, Jack input 1 or WIRC A is used for Counter 1 count up and Jack input 2 or WIRC B for Counter 2 count up.
- If configured as ctrl input, depressing and holding for 3 seconds a jack input will reset the corresponding counter to its initial value.
- All parameters as inputs lock time, initial value, 4 digits prefix, counter color can be set using the Menu Buttons or via our setup Apps.
- Settings allow the possibility to hide the leading '0'.
- If RS232 protocol is set to "DISPLAY FDS", then each time the counter is refresh, a Display frame is sent on the RS232 port.

10.6. Start-Clock Mode

This mode enables MLED Display to be used as a fully configurable start clock.

Different sequences, layouts with traffic lights, count-down value and text, can be selected according to the user defined selections.

External Jack inputs 1 & 2 control the start/stop and reset functions. Full control is also possible from our mobile Apps.

10.6.1. User defined sequence.

Guideline for a proper countdown sequence setting:

** For reference: TOD = Time of Day

1. Select whether a manual countdown or automatic start at a defined TOD value is required. If TOD is selected, countdown will start before TOD value in order to reach zero at the selected TOD.
2. Set the number of countdown cycles. If more than one cycle, the interval between cycles has also to be defined. **For proper operation, the interval value must be greater than the sum of the countdown value and the « End of countdown time ».** A value of '0' means infinite number of cycles.
3. Set the countdown value, initial color and color change threshold, as well as audible beep if required.
4. Select the desired countdown layout (see description below).
5. According to the selected layout, all other relevant parameters should be configured.

Before countdown:

After initial power-up, the display enters a "wait for synchro" state. The default synchro is defined in the settings. Other synchronization methods can be initiated via our IOS Application. Once the synchro completed, the state changes to "wait for countdown". According the selected parameters, the Countdowns will either be started manually or automatically at a predefined time of day.

During the "wait for countdown" state, a predefined message can be displayed on the upper and lower lines as well as TOD.

During countdown:

Depending on the selected layout, information like countdown value, lights and text will be displayed. Countdown value and traffic light color will change according to the following rules:

- When the countdown starts, the main color is defined by the parameter « Countdown Color ».
- Up to 3 color sectors can be defined. When the countdown reaches the time defined in a sector, the color changes according to the sector definition. Sector 3 has priority over sector 2 which has priority over sector 1.
- Countdown will stop at the value defined by the parameter « Countdown end time» its value can be set from 0 to 30sec after countdown reaches 0.
- When the countdown reaches zero, a time frame is sent on the RS232 together with a synchro pulse.

- When the countdown end time is reached, the TOD is displayed until the next countdown.

3 audio beeps can be programmed independently. A threshold for continuous beeps (every second) can also be defined. Continuous beeps will sound until countdown reaches zero (0 will have a higher pitch and longer duration tone).

In some Layouts a text can be displayed during and at the end of the countdown. For example, "GO"

Countdown layouts:

A) Counter only

Full size Countdown value is displayed.

B) Counter and text

Full size countdown value is displayed until it reaches zero. On reaching zero a Text is displayed instead.

C) 5 Lights Off

Initially full-size countdown value is displayed. At value = 5, five full traffic lights replace the value. Traffic light colors are defined according to the sectors definition. Every second a light is turned off. At zero, all lights are turned back according to the sector's color.

D) 5 Lights On

Initially full-size countdown value is displayed. At value = 5, five empty traffic lights replace the value. Traffic lights color is set according to the sectors definition. Every second a light is turned on until zero is reached.

E) Cnt 2 Lights

Full size countdown value is displayed (max 4 digits) as well as 1 traffic light on each side.

F) Cnt Text 2 Lights

Full size countdown value is displayed (max 4 digits) as well as 1 traffic light on each side. When zero is reached a text replaces the countdown.

G) TOD Cnt

Time of day is displayed on the upper left side.

A full-size Countdown value is displayed (max 3 digits) on the right side.

H) TOD Cnt 5Lt Off

Time of day is displayed on upper left side.

A full-size Countdown value is displayed (max 3 digits) on the right side.

When the countdown reaches 5, five full small traffic lights appear on the bottom left side under the TOD. Light colors are set according to the sectors defined. Every second a light is turned off. At zero, all lights are turned back on with sector's color.

I) TOD Cnt 5Lt On

Time of day is displayed on upper left side.

A full-size Countdown value is displayed (max 3 digits) on the right side.

When the countdown reaches 5, five empty small traffic lights appear on the bottom left side under the TOD. Light colors are set according to the sectors defined.

Every second a light is turned On until zero is reached.

J) 2 Lines Text Cnt

During countdown, the value is displayed on the bottom line with traffic lights on each side. The upper line is filled out with a user defined text.

When the countdown reaches zero, the upper line changed to a second user defined text, and the countdown value on the bottom line is replaced by a third text.

K) Bib TOD Cnt

Time of day is displayed on upper left side.

A full-size Countdown value is displayed (max 3 digits) on the right.

The bib number is displayed on the bottom left side under the TOD.

At the end of each cycle, the next Bib value is selected. The Bib list can be downloaded into the display via the IOS app. It is also possible to enter manually on the fly each Bib with the app.

Start CntDown mode:	Manual start or start at defined TOD
Manual start sync:	Manual start can be defined to start at the next 15s, 30s or 60s. If 0 is set the countdown start immediately
Cycles number:	Number of countdown cycles performed automatically once the first is started (0 = nonstop)
Cycles time interval:	Time between each countdown cycle This value must be equal or greater than the "countdown value" plus the "end of countdown time"
Countdown value:	Countdown time in seconds
Countdown color:	Initial color for countdown
Sector 1 time:	Start of sector 1 (compared to countdown value)
Sector 1 color:	Color of sector 1
Sector 2 time:	Start of sector 2 (compared to countdown value)
Sector 2 color:	Color of sector 2
Sector 3 time:	Start of sector 3 (compared to countdown value)
Sector 3 color:	Color of sector 3
End of Countdown:	Time at which a countdown cycle is completed. Value goes from 0 to -30sec. Sector 3 color is used
Beep 1 time:	Countdown time of the first beep (0 if not used)
Beep 2 time:	Countdown time of the second beep (0 if not used)
Beep 3 time:	Countdown time of the third beep (0 if not used)
Continuous Beep:	Countdown time at which a beep is generated every second until zero is reached.

For Layouts (B, F, J)

Final Text down: Text displayed in the center when countdown reaches zero

For Layout (J)

Up text CntDwn: Text displayed on upper line during countdown

Up text at 0: Text displayed on upper line when countdown reaches zero

Up text CntDwn color: Upper line text color during countdown

Up text at 0 color: Upper line text color when countdown reaches zero

10.6.2. Kart CIK sequence

Initial display state:	All lights ON (Red)
On Start:	All lights OFF -> Running time after 10sec if enabled or wait for reset.
On Pause:	Last light flash amber (wait for reset)
On Reset:	back to initial state

10.6.3. Kart Corporate sequence

Initial display state:	Blank
On Start:	Traffic lights turn ON (Red) one by one every seconds.
On Pause:	Traffic lights remain ON until reset.
On Reset:	back to initial state
Once all Lights ON:	If not in pause, Random timer is started (0,2s – 3s)
Once Time elapse:	All lights GREEN -> Running time after 10sec if enabled or back to initial state.

10.6.4. FIM Motorcycle Racing sequence

Initial display state:	Blank
On Start:	All traffic lights ON (Red), Random timer is started (2s – 5s)
On Pause:	If time not elapse all lights remain ON until reset
On Reset:	back to initial
Once Time elapse:	All lights OFF -> Running time after 10sec if enabled or back to initial state

10.6.5. FIA Car Racing sequence

Initial display state:	Blank
On Start:	Traffic lights turn ON one by one every seconds
On Pause:	Traffic lights remain ON until reset.
On Reset:	back to initial
Once all Lights ON:	If not in pause, Random timer is started (0,2s – 3s)
Once Time elapse:	All lights OFF -> Running time after 10sec if enabled or back to initial state

10.7. Factory settings

Factory settings can be restored by pressing both UP & DWN selection switches on DBox during power up.

- All parameters will be reset to default.
- Bluetooth password will be reset to “0000”
- Bluetooth will be activated if previously disabled
- Bluetooth will enter DFU mode (for a firmware maintenance)

Once reset completed, power will have to be recycled (OFF/ON) in order to resume normal operation.

11. Display communication Protocol USB/RS232/RS485

For basic text strings (no color control), the MLED-CTRL box is compatible with FDS and TAG Heuer display protocol.

11.1. Basic Format

<STX>NLXXXXXXXX<LF>

STX = 0x02
 N = line number <1..9, A..K> (total 1 ... 20)
 L = brightness <1..3>
 X = characters (up to 64)
 LF = 0x0A

Format: 8bits / no parity / 1 stop bit
 Baud Rate: 9600bds

11.2. Characters Set

All standard ASCII characters <32 .. 126> excepted for the char ^ which is used as delimiter

!"#\$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMN OPQRSTUVWXYZ
 [\]_`abcdefghijklmnopqrstuvwxyz{|}~

Extended Latin ASCII characters (ISO-8859-1) <224 .. 255>
 àáâãäåæçèéêëìíîïðñòóôõö÷øùúûüýþÿ

11.3. FDS extended commands.

The following specification is valid for firmware version V2.3.0 and above.
 Inline commands can be added in a display frame between the ^^ delimiters.

Command	Description
^cs c^	Color overlay
^cp s e c^	Color overlay between two characters position
^tf p c^	Display a Traffic Light at position (Filled)
^tb p c^	Display a Traffic Light at position (Border only)
^ic n c p ^	Display an icon (among proposed icons)
^fi c^	Fill all display
^fs n s c^ ^fe^	Flash part of a text
^fd n s c^	Flash full line
^rt f hh:mm:ss^ ^rt f hh:mm:ss.d^ ^rt f mm:ss^ ^rt f mm:ss.d^ ^rt f sss^ ^rt f sss.d^	Display a running time.

Color overlay:

Command	Description
^cs c^	<p>Color overlay</p> <p>cs = start color overlay cmd c = color code (1 or 2 digits : <0 ... 10>)</p> <p><i>Example A:</i> <STX>13Welcome ^cs 2^FDS^cs 0^Timing<LF></p> <p>“Welcome” and “Timing” are in the default line color “FDS” is in Green</p> <p><i>Example B:</i> <STX>23^cs 3^Colour^cs 4^ Display<LF></p> <p>“Color” is in Blue “Display” is in Yellow</p> <p>Color overlay is only applied in the current received frame.</p>

Text color at position:

Command	Description
^cp s e c^	<p>Set color overlay between two characters position (permanent)</p> <p>cp = cmd s = first character position (1 or 2 digits : <1 .. 32>) e = last character position (1 or 2 digits : <1 .. 32>) c = color code (1 or 2 digits : <0 ... 10>)</p> <p><i>Example:</i> <STX>13^cp 1 10 2^^cp 11 16 3^ <LF></p> <p>Characters position 1 to 10 are defined in Green Characters position 11 to 16 are defined in Blue</p> <p>This setting is saved in non-volatile memory and is applied to all following received frame.</p>

Display a traffic light at position (Filled):

Command	Description
^tf p c^	<p>Display a filled traffic light at a defined position.</p> <p>tf = cmd p = position starting from the left (1 .. 9). 1 inc = 1 traffic light width c = color code (1 or 2 digits : <0 ... 10>)</p> <p><i>Example:</i> <STX>13^tf 1 2^^tf 2 1^ <LF></p> <p>Display a green and a red traffic Light on the left of the display. This will overlay any other data. The rest of the display is not modified. Do not add text in the same frame.</p>

Display a traffic light at position (Border only):

Command	Description
^tb p c^	<p>Display a traffic light (border only) at a defined position.</p> <p>tb = cmd p = position starting from the left (1 .. 9). 1 inc = 1 traffic light width c = color code (1 or 2 digits : <0 ... 10>)</p> <p><i>Example:</i> <STX>13^tb 1 2^^tb 2 1^ <LF></p> <p>Display a green and a red traffic Light on the left of the display. This will overlay any other data. The rest of the display is not modified Do not add text in the same frame.</p>

Display an icon:

Command	Description
^is n c p^	<p>Display an icon inline a text or at a defined position.</p> <p>is = cmd c = color code (1 or 2 digits : <0 ... 10>) p = position starting from the left (*optional) <1...32> 1 inc = ½ icon width</p> <p><i>Example 1:</i> <STX>13^is 1 2 2^<LF></p> <p>Display a small green traffic light at position 2</p> <p><i>Example 2:</i> <STX>13^is 5 7^Finish<LF></p> <p>Display a white checker flag on the left followed by the text 'Finish'</p> <p>* If this parameter is omitted, the icon is displayed before, after or between a text. Text can be added in the same frame. If this parameter > 0 then the icon will be displayed at the defined position overlaying any other data. Do not add text in the same frame.</p> <p>Icon list: 0 = reserved 1 = small traffic light filled 2 = small traffic light empty 3 = traffic light filled 4 = traffic light empty 5 = Checker flag</p>

Fill all display:

Command	Description
<code>^fi c^</code>	<p>Fill with a defined color the full display area. Only 50% of the LEDs are turned on to reduce current and heating</p> <p>fi = cmd c = color code (1 or 2 digits : <0 ... 10>)</p> <p><i>Example:</i> <STX>13^fi 1^ <LF></p> <p>Fill the display line with the red color.</p>

Flash a full line:

Command	Description
<code>^fd n s c^</code>	<p>Flash a full line</p> <p>fd = cmd s = Speed <0 ... 3> n = Number of flash <0 ... 9> (0 = permanent flashing) c = color code *optional (0 - 2 digits : <0 ... 10>)</p> <p><i>Example:</i> <STX>13^fd 3 1^<LF></p> <p>Flash the line 3 times at speed 1</p>

Flash a text:

Command	Description
<code>^fs n s c^ ^fe^</code>	<p>Flash a text</p> <p>fs = Start of text to flash cmd fe = End of text to flash cmd s = Speed <0 ... 3> n = Number of flash <0 ... 9> (0 = permanent flashing) c = color code *optional (0 - 2 digits : <0 ... 10>)</p> <p><i>Example:</i> <STX>13^fs 3 1^FDS^fe^ Timing<LF></p> <p>Display the text "FDS Timing". The word 'FDS' is flashing 3 times. Color is not present so Black by default.</p>

Display a running time:

Command	Description
<code>^rt f hh:mm:ss^</code> <code>^rt f hh:mm:ss.d^</code> <code>^rt f mm:ss^</code> <code>^rt f mm:ss.d^</code> <code>^rt f sss^</code> <code>^rt f sss.d^</code>	<p>Display a running time</p> <p>rt = cmd f = Flags <0 ... 7> (bit0 = remove leading 0; bit1 =countdown) hh = hours <0 ... 99> mm = minutes <0 ... 59> sss = seconds <0 ... 999> ss = seconds <0 ... 59> d = decimal</p> <p><i>Example 1:</i> <STX>13^rt 0 10:00:00^<LF> <STX>13^rt 0 10:00:00.5^<LF></p> <p>Display a clock starting at 10h. A decimal can be added for a better synchronization, however if the display is 8 digits wide, the decimal is not showed.</p> <p><i>Example 2:</i> <STX>13^rt 1 00:00.0^<LF></p> <p>Display a running time in mm:ss.d from 0, hiding the leading zero.</p>

Color code:

code	Color
0	Black
1	Red
2	Green
3	Blue
4	Yellow
5	Magenta
6	Cyan
7	White
8	Orange
9	Deep pink
10	Light Blue

12. How to update the firmware

No software is required.

- a) Power up the DBox while pressing the 'Enter' switch (this activate the USB drive).
- b) Copy and paste the ".bin" file to the USB Flash Drive root directory of the DBox.
Note that you should have only ONE ".bin" file on the drive. If you want to save the previous ".bin" files, create a sub-directory
- c) Delete the file "UPDATLOG.txt" if it exists on the DBox drive
- d) Disconnect the USB and power connector from your DBox.
- e) Wait 1-2 seconds and power up the DBox.
All LED's will switch yellow for a few seconds and update is complete when extinguished
- f) A file "UPDATLOG.txt" is created on the Drive. Open it and check that the update completes with success. **Do not delete this file.**

13. Technical specifications

Power supply	12V-24V (+/- 10%) USB-C 5V (doesn't power MLED)
Radio frequencies & Power:	
Europe	869.4 - 869.65 MHz 100mW
India	865 - 867 MHz 100mW
North America	920 - 924 MHz 100mW
Japan	922 - 927 MHz 20mW
Russia	868.7 - 869.2 MHz 100mW
Inputs precision	1/10'000 sec
Operating temperature	-20°C to 60°C
Time drift	1ppm @ 20°C; max 2.5ppm from -20°C to 60°C
Bluetooth module	BLE 5
Dimensions	159x90x20
Weight	240g

14. Copyright and Declaration

This manual has been compiled with great care and the information it contains has been thoroughly verified. The text was correct at the time of printing, however the content can change without notice. FDS accepts no liability for damage resulting directly or indirectly from faults, incompleteness or discrepancies between this manual and the product described.

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